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EXAMINER

SELLERS, ROBERT E

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1712

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**BEFORE THE BOARD OF PATENT APPEALS  
AND INTERFERENCES**

Application Number: 09/664,332  
Filing Date: September 18, 2000  
Appellant: HAYASHI, NORIYA

Daniel A. Geselowitz  
For Appellant

**EXAMINER'S ANSWER**

**MAILED**  
DEC 21 2005  
**GROUP 1700**

This is in response to the appeal brief filed November 22, 2005 appealing from the Office action mailed July 7, 2005.

**(1) Real Party in Interest**

A statement identifying by name the real party in interest is contained in the brief.

**(2) Related Appeals and Interferences**

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

**(3) Status of Claims**

The statement of the status of claims contained in the brief is correct.

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**(4) Status of Amendments After Final**

The statement of the status of amendments after final rejection contained in the brief is correct.

**(5) Summary of Claimed Subject Matter**

The summary of claimed subject matter contained in the brief is correct.

**(6) Ground of Rejection to be Reviewed on Appeal**

The statement of the ground of rejection to be reviewed on appeal is correct.

**(7) Claims Appendix**

The copy of the appealed claims contained in the Appendix to the brief is correct.

**(8) Evidence Relied Upon**

5,359,017	HAMAZU et al.	10-1994
5879859	BUCHWALTER et al.	3-1999
5,384,339	STARKEY	1-1995
4,252,592	GREEN	2-1981
4,299,938	GREEN et al.	11-1981

**(9) Ground of Rejection**

The following ground of rejection is applicable to the appealed claims. The text of section 103(a) of Title 35, U.S. Code not included in this action can be found in a prior Office action.

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Claims 1-3, 6-8, 10, 12, 22, 27 and 28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hamazu et al. Patent No. 5,359,017; Buchwalter et al. Patent No. 5,879,859; Starkey Patent No. 5,384,339 and Green Patent No. 4,252,592 in view of Green et al. Patent No. 4,299,938 (Green et al. '938).

Hamazu et al. (col. 1, lines 56-60) discloses a radiation and heat curable (col. 29, lines 57-60) molding or sealing (col. 5, line 17) composition comprising a cationically polymerizable organic material shown by the elected species of 3,4-epoxycyclohexylmethyl-3,4-epoxycyclohexane carboxylate (col. 15, Examples 33-38, lines 34-35), from 0.01 to 20 parts by weight per 100 parts by weight of the cationically polymerizable organic material (col. 3, lines 56-61) of a cationic polymerization catalyst shown by the elected species of benzyl-4-hydroxyphenylmethyl sulfonium hexafluoroantimonate (col. 3, lines 29-30 and the col. 7 catalyst) embraced by claimed general formula (IV) and an acid anhydride (col. 5, line 14).

Buchwalter et al. (col. 2, lines 24-26) sets forth a composition containing a cycloaliphatic diepoxide, from about 0.5% to about 10% by weight based on the solid resin weight (col. 7, lines 2-4) of a photoactive compound such as a hydroxyaryl dialkyl sulfonium hexafluoroantimonate or hexafluorophosphate (col. 4, line 57 to col. 5), a cyclic anhydride such as the elected species of maleic anhydride (col. 6, lines 50-54 and 64-65), and a polyethylene glycol (col. 7, line 12) falling within the claimed polyhydric alcohol of claims 6, 7 and 10.

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Starkey et al. (col. 3, lines 7-11) espouses an ultraviolet light-curable paste-like (col. 2, lines 51-53) formulation prepared from an epoxy resin such as 3,4-epoxycyclohexylmethyl-3,4-epoxycyclohexane carboxylate (col. 4, lines 16-18), from 0.1 to 4 parts by weight based on the solid components (col. 13, lines 10-14) of a photoinitiator such as an aromatic sulfonium salt of a halogen-containing complex ion (col. 12, lines 35-36), from about 0.01 to 10 parts by weight based on 100 parts by weight of the resin component (col. 21, lines 12-16) of a thermohardening catalyst such as maleic anhydride (col. 20, lines 38-39), and up to 100.0 parts by weight per 100 parts by weight of epoxy resin (col. 3 table, line 47) of polyethylene glycols (col. 7, line 31).

Green (col. 2, lines 7-14) describes an ultraviolet and thermally curable (col. 7, lines 18-21) blend of an epoxide resin such as 3,4-epoxycyclohexylmethyl-3,4-epoxycyclohexane carboxylate (col. 4, lines 1-2), from 0.1 to 20 parts by weight per 100 parts by weight of the epoxide resin (col. 8, lines 9-11) of an aromatic sulphonium hexafluoroantimonate or hexafluorophosphate photopolymerization catalyst (col. 5, lines 49, 53, 56-57), and a heat-activated curing agent such as a polycarboxylic acid anhydride (col. 4, lines 16-17).

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Hamazu et al. discloses but does not exemplify the claimed acid anhydride curing agent. The use of acid anhydrides is described in column 5, line 14. It would have been obvious to employ the acid anhydride disclosed in Hamazu et al. in order to implement both radiation and heat curing (col. 1, lines 55-56 and col. 29, lines 57-60) for a more thorough cure as implemented in Starkey (col. 20, lines 10-13 and 38-45).

Buchwalter et al., Starkey and Green set forth aromatic sulfonium hexafluoroantimonates or hexafluorophosphates in general without specifying a structure within claimed general formula (IV), (IV') or (V). Hamazu et al. discloses the elected species of benzyl-4-hydroxyphenylmethyl sulfonium hexafluoroantimonate (col. 3, lines 29-30 and the col. 7 catalyst) embraced by claimed general formula (IV).

It would have been obvious to employ the benzyl-4-hydroxyphenylmethyl sulfonium hexafluoroantimonate of Hamazu et al. as the aromatic sulfonium photopolymerization initiator of Buchwalter et al., Starkey and Green in order to optimize the radiation curability.

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The claimed curing agent:photopolymerizable resin molar ratio of from 0.3:1 to 1.4:1 is not broadly recited. Buchwalter et al. (col. 9, Example 1, lines 53-55) shows a blend of 1.8 parts by weight of acetal diepoxide (i.e. acetaldehyde bis(3,4-epoxycyclohexylmethyl)acetal according to col. 3, lines 3-15) and 0.91 part by weight of hexahydrophthalic anhydride. The molar amount of anhydride is  $0.91 \div 154.17 \text{ g/mole} = 0.0059 \text{ mole}$ . The molar content of diepoxide is  $1.8 \div 283 \text{ g/mole} = 0.0064 \text{ mole}$ . The molar ratio of curing agent:photopolymerizable resin is  $0.0059 \div 0.0064 = 0.93:1$  which is within the claimed parameters.

Starkey espouses as much as 10 parts by weight per 100 parts by weight of the resin component (col. 21, lines 12-19) of a thermohardening catalyst such as the elected species of maleic anhydride per 100 parts by weight of an epoxy resin such as the elected species of 3,4-epoxycyclohexylmethyl-3,4-epoxycyclohexane carboxylate exhibited in col. 21, Example 2, lines 58-59, UVR6105; col. 22, Example 3, lines 22-23, CY-179 and col. 23, Example 5, lines 13-14, UVR6110). The molar proportion of maleic anhydride is  $10 \div 98.6 \text{ g/mole} = 0.10 \text{ mole}$ . The molar quantity of the epoxy resin is  $100 \div 316 \text{ g/mole} = 0.316 \text{ mole}$ . The molar ratio of curing agent:photopolymerizable resin is  $0.10 \div 0.316 = 0.32:1$  which is greater than the claimed minimum of 0.3:1.

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It would have been obvious to utilize the anhydride curing agent of Hamazu et al. and Green at the molar ratios of 0.32:1 or 0.93:1 shown in Starkey and Buchwalter et al., respectively, in order to complete the curing of the epoxy resins and to attain sufficient strength without crystal precipitation or decreased stability (Starkey, col. 21, lines 17-23).

The claims require a sulfonium salt of general formula (IV), IV') or (V) as a photopolymerization initiator which "makes it possible" to cure by chain reaction the photopolymerizable resin with radiation. The phrase "which makes it possible" merely indicates the capability of curing by chain reaction and is not an affirmative limitation requiring the curing of the photopolymerizable resin by chain reaction. Even if, arguendo, the limitation is given weight, the prior art radiation-curable combinations of epoxy photopolymerizable resin and aromatic sulfonium salt such as the elected species exemplified in Hamazu et al. used in concentrations within the claimed range inherently cures by a mechanism within the claimed chain reaction.



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Claims 2, 3, 6, 7, 10 and 12 require the presence of a curing accelerator such as polyethylene glycol (claim 10). Buchwalter et al. and Starkey set forth polyethylene glycol.

Green et al. '938 (col. 4, line 50 to col. 5, line 22) is directed to an actinic radiation and heat curable mixture of a cationic-polymerizable compound such as 3,4-epoxycyclohexylmethyl-3',4'-epoxycyclohexanecarboxylate (col. 7, lines 54-55), an aryloxysulfoxonium salt photoinitiator, a polycarboxylic acid anhydride (col. 12, lines 17-19) and a polyethylene glycol co-curing agent (col. 7, line 67 to col. 8, lines 5 and 13-14).

It would have been obvious to incorporate the polyethylene glycol co-curing agent of Green et al. '938 together with the polycarboxylic acid anhydride in order to optimize the cure rate.

**(10) Response to Arguments**

The arguments presented on pages 15-25 of the appeal brief will be addressed *seriatim*.

Starkey shows an epoxy resin such as 3,4-epoxycyclohexylmethyl-3',4'-epoxycyclohexanecarboxylate of Examples 2, 3 and 5 and discloses from about 0.01 to 10 parts by weight per 100 parts by weight of the resin component of a thermohardening catalyst (col. 21, lines 11-23) such as maleic anhydride (col. 20, lines 38-39). Accordingly, a combination of the elected species of epoxy resin and as much as 10 parts by weight of maleic anhydride is clearly within the purview of the patent. The calculated ratio of curing agent (i.e. maleic anhydride) to photopolymerizable resin (i.e. epoxy resin) of 0.32:1 is based purely on the specific teachings of Starkey wherein the claimed elected species of acid anhydride curing agent and epoxy photopolymerizable resin are tangibly named therein. The calculated ratio is not compromised merely because of the upper limit of the proportion range and the low molecular weight of the curing agent. The types of epoxy resin and curing agent in the molar ratio reflects the elected species which are affirmatively elucidated in Starkey.

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The calculated molar ratio of 0.32:1 in Starkey is not predicated upon an improper picking and choosing of optional components and ranges in a reference. Starkey establishes the incentive to include a thermohardening catalyst "for catalyzing the thermal reaction of the epoxy group (col. 20, lines 10-12)" at a level of from about 0.01 phr (part per hundred of resin) to about 10 phr to impart sufficient strength (col. 21, lines 12-23). The particular epoxy resin and thermohardening catalyst was selected in consideration of those most pertinent to the claims which are the elected species of 3,4-epoxycyclohexylmethyl-3',4'-epoxycyclohexanecarboxylate repeatedly shown in Starkey and maleic anhydride curing agent. Furthermore, the elected species of epoxy resin is exhibited in Examples 2, 3 and 5.

It would have been obvious to incorporate the thermohardening catalyst of Starkey in order to ensure the reaction of the epoxy groups of the epoxy resin during cure while providing sufficient strength. It is clearly within the confines of Starkey to add the thermohardening catalyst at a quantity of 10 phr and to use the elected species of maleic anhydride.

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The claimed molar ratio of curing agent:photopolymerizable resin is not based entirely on Starkey. Buchwalter et al. sets forth a calculated molar ratio of 0.93 :1 embraced by the claimed limits of from 0.3:1 to 1.4:1. Hamazu et al. and Green reports blends of cycloaliphatic epoxy resin and acid anhydride as found in Starkey and Buchwalter and are analogous thereto. Thus, it would have been obvious to combine the cycloaliphatic epoxy resins and acid anhydrides of Hamazu et al. and Green at molar ratios of 0.32:1 and 0.93:1 as per Starkey and Buchwalter et al. in order to complete the curing of the epoxy resins and to attain sufficient strength without crystal precipitation or decreased stability (Starkey, col. 21, lines 17-23).

Hamazu et al. (col. 3, lines 56-61), Buchwalter et al. (col. 7, lines 2-4), Starkey (col. 13, lines 10-21) and Green (col. 8, lines 9-12) each espouse proportions of photopolymerization initiator encompassing the claimed parameters. Hamazu et al. acknowledges the use of the elected species of benzyl-4-hydroxyphenylmethyl sulfonium hexafluoroantimonate (col. 3, lines 29-30 and the col. 7 catalyst) as a suitable species thereof. It would have been obvious to employ the benzyl-4-hydroxyphenylmethyl sulfonium hexafluoroantimonate of Hamazu et al. as the aromatic sulfonium photopolymerization initiator of Buchwalter et al., Starkey and Green in order to optimize the radiation curability.

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The amount of acid anhydride curing agent has been defined differently from the concentrations shown in Starkey and Buchwalter et al. The claimed amount is not distinguishable simply due to its denotation as a molar ratio of curing agent to photopolymerizable resin. Since Starkey and Buchwalter et al. inconveniently set forth relative proportions of epoxy resin as parts per hundred of resin and a single exemplified content, respectively, a conversion of these values to the claimed molar proportion is necessary to ascertain whether the claimed amount is described in the patents. It has been unequivocally established on the record that Starkey discloses a molar ratio of 0.32:1 and Buchwalter et al. exhibits one of 0.93:1.

The teachings of Buchwalter are not confined to the specific level of photopolymerization initiator in Example 1 since a range of from about 0.5% to about 10% by weight is found in column 7, lines 1-4. The reliance upon Example 1 to indicate the concentration of acid anhydride curing agent cannot be relied upon to dismiss the level of photoinitiator which is greater in Example 1 than that claimed. The teachings of the prior art as a whole must be taken into consideration when determining if the limitations of the claims are taught thereby. The consideration of Buchwalter et al. as a whole establishes a molar ratio of acid anhydride curing agent of 0.93:1 since it is the only amount disclosed therein, along with a proportion of photopolymerization initiator of from about 0.5% to about 10% by weight.

Buchwalter et al. meets both limitations of the molar proportion of curing agent: photopolymerizable resin and amount of photopolymerization initiator considering the exemplified molar proportion of 0.93:1 and the disclosed content of photopolymerization initiator of from about 0.5% to about 10% by weight, respectively.

The 37 CFR 1.132 declaration filed May 13, 2004 (Declaration II) along with Comparative Examples 2 and 3 on pages 75-76 of the specification and the 37 CFR 1.132 declaration (Declaration I) filed March 3, 2003 have been cited as alleged evidence of the criticality of the claimed possibility of curing by chain extension.

Comparative Examples 2 and 3 contain 100 parts by weight of Celloxide 2021P which is 3,4-epoxycyclohexylmethyl-3',4'-epoxycyclohexanecarboxylate (page 66, lines 1-3) and 1.5, 1.0, 1.0 and 0.5 parts by weight of photopolymerization initiators conforming to claimed general formulae (IV). Added Examples 1 and 2 of Declaration I are obtained from Celloxide 2021P, maleic anhydride and 0.5 part by weight of photopolymerization initiators within general formula (IV).

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The evidence is not commensurate in scope with the claims with respect to a representative sampling of the claimed proportion range of from 0.1 to 6.0 parts by weight per 100 parts by weight of the whole weight of the other components.

The testing of levels at the lower limit of the range does not confirm the criticality of the upper limit of 6.0 parts by weight, especially considering the revelation in Starkey that at a quantity exceeding 4 parts by weight, the problems of the precipitation of crystals or insufficient hardening of the lower part occurs when utilizing a photopolymerization initiator such as an aromatic sulfonium halogen-containing complex ion salt (col. 12, lines 35-36 and col. 13, lines 17-21).

The experimentation with the sole species of general formula (IV) does not confirm the criticality of the structurally diverse naphthylmethyl-containing sulfonium salt of claim (IV').

The claims broadly embrace photopolymerizable resin components which include such structurally and functionally diverse species as epoxy acrylates, urethane acrylates, polyester acrylates, polyether acrylates, vinyl acrylates, polystyrylethyl methacrylates, epoxy resins, unsaturated polyesters, polyene/thiols, silicones, polybutadienes, vinyl ether compounds, epoxidized polyolefins, epoxy monomers, acryl monomers, vinyl ethers and cyclic ethers as listed on page 26, lines 4-17. The claimed component is not even restricted to these species and can include even more myriad photopolymerizable components according to page 26, lines 17-18.

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The testing of a single type of epoxy resin does not confer patentability on such diverse photopolymerizable components which contain materially different backbone structures such as ether, urethane, polyester, polyene, silicone and butadiene groups as well as diverse functional groups such as (meth)acrylate, vinyl, epoxy thiol and ether moieties.

Added examples 1 and 2 employ maleic anhydride containing unsaturated groups, whereas the claimed acid anhydride encompasses such chemically different types as saturated cycloaliphatic, aromatic, copolymeric and dianhydride (page 41, Table 6). Comparisons involving a single kind of acid anhydride does not confirm the patentability of such other structurally and quantitatively functionally diverse acid anhydrides within the claimed realm.

Added Example 3 and Added Comparative Examples 1 and 2 of Declaration I test Cyracure UVI-6974 and Daicat 11 sulfonium salt photo-thermopolymerization initiators. Although UVI-6974 is used in Example 1 of Buchwalter et al. and Daicat 11 is part of the mixture of UVI 6990 in Starkey, the deficiencies in terms of the lack of commensurateness of the data concerning the broad scope of the claimed photopolymerizable resin and acid anhydride explained hereinabove also pertain to these examples.



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Declaration II on the last page presents Figure A representing the change in temperature during chain curing of the composition. However, these figures are general depictions of the concept of chain curing. There is no association between the results illustrated in the figures and Comparative Examples 2 and 3 of the specification along with Added Examples 1 and 2 referred to on pages 4-5 of the declaration. None of the lines of the figures is designated as representative of any particular example.

The discussion of the chain curing in general does not distinguish the claimed possibility of chain reaction curing over the radiation curing of the references which is the same means of curing as that claimed.

The declaration filed December 27, 2004 (Declaration III) compares 100 parts by weight of 3,4-epoxycyclohexylmethyl-3',4'-epoxycyclohexanecarboxylate and a photopolymerization initiator of general formula (IV) with molar proportions of maleic anhydride of 0.65:1 (Added Example I, reflective of the claimed composition), zero (Added Example II, representative of the prior art), 0.01:1 (Added Example III, outside of the claimed minimum of 0.3:1) and 2.5:1 (Added Example VI, outside of the claimed maximum of 1.4:1). Why were these particular minimum and maximum ratios chosen when the claimed minimum is greater by an order of magnitude and the claimed maximum is smaller by 179%? The testing of a single molar ratio of 0.65:1 does not establish the criticality of the claimed limits of from 0.3:1 to 1.4:1. The closest prior art molar ratio is the 0.93:1 embodied in Example 1 of Buchwalter et al. which is within the claimed parameters.

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The deficiencies regarding the lack of commensurateness of the broad limits of the claimed molar ratio range, photopolymerizable resin and acid anhydride expressed hereinabove are germane to these examples.

There is no evidence of record demonstrating the criticality of the claimed molar proportion of the acid anhydride curing agent throughout a representative sampling of the claimed molar ratio range of from 0.3:1 to 1.4:1 for a representative selection of the broadly defined photopolymerizable resin and acid anhydride to overcome Hamazu et al., Starkey and Green.

Since Buchwalter et al. shows a molar ratio of 0.93:1 within the claimed boundaries, the issue of criticality respect to this reference rests with the type of photoinitiator which is shown in Hamazu et al. There are no showings addressing the criticality of the claimed photopolymerization initiator throughout a representative sampling of the those represented by general formula (IV), (IV') and (V) at a representative sampling of the concentrations of from 0.1 to 6.0 parts by weight for a representative selection of materials falling within the broadly defined photopolymerizable resin and acid anhydride.

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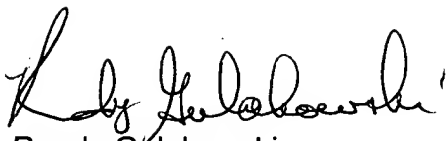
For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

A handwritten signature in black ink, appearing to read "Robert Sellers".

Robert Sellers

Conferees

A handwritten signature in black ink, appearing to read "Randy Gulakowski".

Randy Gulakowski

A handwritten signature in black ink, appearing to read "James Seidleck".

James Seidleck